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(54) Optical device for measuring the fat contents of milk.

(57) An optical device for measuring the fat contents of milk comprises a light source (5), an optical condenser (6), a glass test tube (3), a lens (8), a photosensitive element (9), for example of the CCD type, and a digital display, all enclosed in a metal housing which also holds the control electric and electronic system: the fat contents of the milk being measured by automatically measuring, by means of the photosensitive element, the diffusion depth of the light projected on the milk sample being measured.

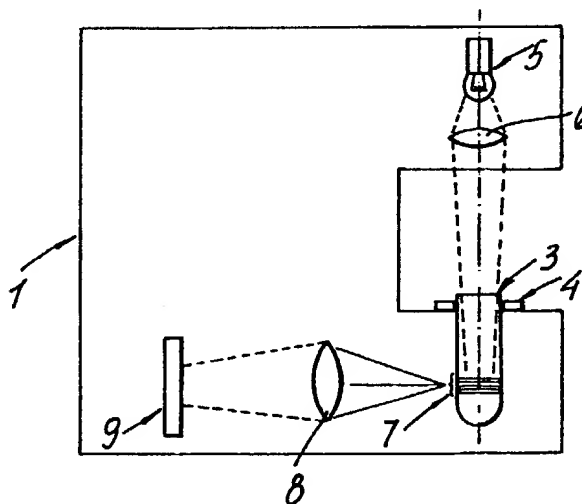


FIG. 2

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## BACKGROUND OF THE INVENTION

The present invention relates to an optical measuring device for measuring the fat contents of milk.

As is known, the milk fat contents is conventionally measured by means of optical systems which are adapted to detect the diffused light coming from the fat particles of the milk: for carrying out this measurement, the milk must be previously homogenized by adding to the milk homogenizing substances adapted to generate in the milk particular phenomena, such as the so-called "trai-ton" phenomenon. However, the homogenizing step causes detection difficulties and, moreover, this step must be carried out by skilled persons.

The fat contents of the milk is also measured by conventional chemical measurement methods based on apparatus for measuring the volume amount of the milk fats: however, even in this case, skilled labour must be used.

## SUMMARY OF THE INVENTION

The main object of the present invention is to provide a very simple, quick, reliable and unexpensive device for carrying out the above mentioned fat measurement, which is very important for example in the dairy production systems.

According to one aspect of the present invention, the above mentioned object, as well as yet other objects, which will become more apparent hereinafter, are achieved by an optical measurement device for measuring the fat contents of milk comprising a light source, an optical condenser and a glass test tube, a trap, a lens and a photosensitive element, for example of the CCD type, and a digital display, characterized in that the milk fat contents is measured by automatically measuring, by means of said photosensitive element, the diffusion depth of the light projected on a milk sample being measured.

The subject measuring device, in particular, provides the following very important advantages:

- the operation of the device is very simple;
- it practically overcomes any measurement errors;
- it does not require, for carrying out the fat measurement, that the milk sample be processed by homogenizing processes or additioned with reactive substances;
- the milk samples to be measured can be prepared in a very quick and simple way;

- the measurement can be carried out by unskilled persons;
- the measurement cost is reduced to a minimum since the measurement requires a very small time;
- it provides very accurate and reliable measurement results;
- it can be easily serviced and cleaned.

## BRIEF DESCRIPTION OF THE DRAWINGS

Further characteristics and advantages of the device according to the present invention will become more apparent from the following detailed disclosure of a preferred embodiment thereof which is illustrated, by way of an indicative but not limitative example, in the accompanying drawing, where:

Figure 1 is a side perspective view showing a possible embodiment of the milk fat measuring device according to the present invention; and

Figure 2 schematically shows the main parts included in the measuring device according to the invention.

## DESCRIPTION OF THE PREFERRED EMBODIMENT

With reference to the figures of the drawing, the optical measuring device for measuring the fat contents of milk comprises a light source 5 (for example a lamp), a condenser 6, a glass test tube 3, trap 4 for housing the glass test tube 3 adapted to properly restrain said test tube, a lens 8, a photosensitive element 9, for example of the CCD type, and a digital display 2, so arranged as to facilitate the read out of the measurement results.

The above disclosed parts are enclosed in a metal shaped housing 1 which also encloses all of the electronic components forming the electronic system, not specifically disclosed, for controlling the measurement device.

For carrying out the fat contents measurements, the following steps must be carried out:

I - introducing into the glass test tube 3, in a cleaned and dry condition, an accurately metered amount of the milk sample to be measured, by using a conventional pipette;

II - arranging the glass test tube 3 in the seat or "trap" 4 while holding said test tube in a vertical

position, so as to locate said test tube at a set read-out position;

III - switching on the lamp 5 so as to cause the light beam produced by said lamp to impinge on the test tube 3 and the milk held therein. In this connection it should be pointed out that the light beam will be preliminarily concentrated by the lens 6 so as to properly impinge on the surface of the milk held in the test tube;

IV - holding the test tube and the milk contained therein always in the mentioned constant set position since the detection accuracy of the device will depend on said position, indicated at 7. In this connection it should be apparent that the light depth penetration will be inversely proportional to the emulsified fat particles present in the milk sample, and this according to a logarithmic law;

V - directly projecting, by the lens 8, the light beam exiting the test tube 3 on the photosensitive element 9;

VI - electronically controlling said photosensitive element 9 to cause it to generate a signal indicative of the place 7 it comes from, and sending an electrical signal indicative of the milk fat contents to the display 2;

VII - reading on the display 2 the value of the measured milk fat contents.

It should be apparent that the several detection and display signals will be suitably processed by the electronic system included in the device and which can be easily designed by one skilled in the electronic art.

While the invention has been disclosed and illustrated with reference to a preferred embodiment thereof, it should be apparent that the disclosed embodiment is susceptible to several modifications and variations all of which will come within the spirit and scope of the appended claims.

## Claims

1. An optical measuring device for measuring the fat contents of milk, comprising a light source, an optical condenser, a glass test tube, a lens, a photosensitive element and a digital display, all of which are enclosed in a metal housing also holding an electronic control system for said device, wherein said milk fat contents is measured by automatically measuring, by means of said photosensitive element, the diffusion depth of the light projected on a milk sample being measured.

2. A device according to claim 1, wherein said photosensitive element is of the CCD type and is adapted to automatically measure the depth of the light diffused from a milk sample held in said test tube and arranged at a set position.

3. A device according to claim 1, wherein said

device comprises a light projecting assembly including a lamp and an optical condenser said assembly being adapted to illuminate with a set illumination level said milk sample in said test tube.

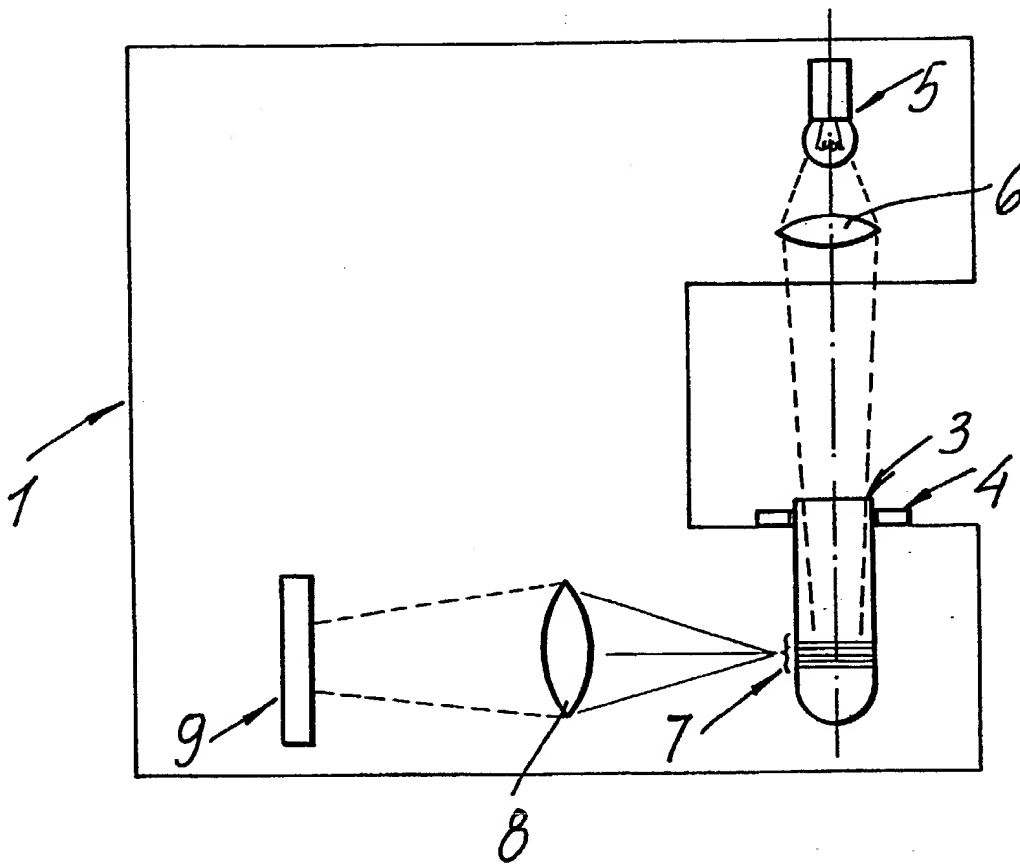
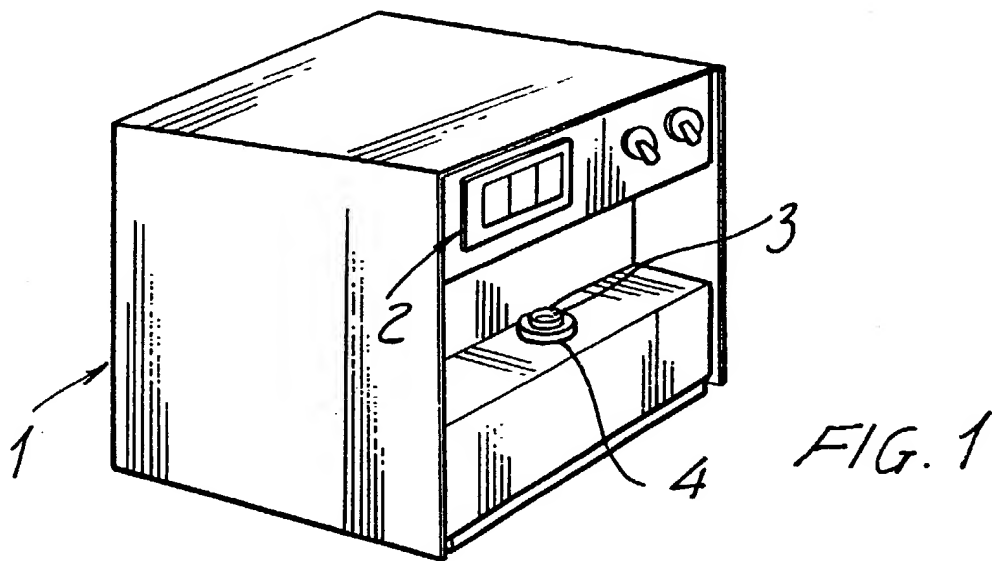
4. A device according to claim 1, wherein said test tube is arranged in a restraining trap therefor.

5. A device according to claim 1, wherein said lens is adapted to properly focalize the light diffused on said photosensitive element.

6. A device according to claim 1, wherein said photosensitive element is adapted to carry out an accurate read out of the diffused light amount coming from said milk sample.

7. A device according to claim 1, wherein said display is adapted to provide a digital display of the measurement taken by said photosensitive element.

8. A device according to claim 1, characterized in that said device further comprises an electronic control system for processing the electrical signals provided by said photosensitive element.





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# EUROPEAN SEARCH REPORT

Application Number

EP 90 83 0096 ✓

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	SOVIET INVENTIONS ILLUSTRATED, Derwent Publications, Section Chemical week K33, 28 September 1983, abstract no. 739422, D13S03; & SU-A-964528 (Kuban Agric Inst.) 07.10.1982 ----	1,3,5,6	G 01 N 33/06 ✓
A	US-A-2 844 067 (E.M. BORG) * column 2, line 19 - column 3, line 69 *	1	
A	GB-A-1 059 825 (N. FOSS ELECTRIC A/S) * claim 7 *	1	
A	SOVIET INVENTIONS ILLUSTRATED, Derwent Publications, Section Chemical week K 29, 31 August 1983, abstract no. 715443, D13S03; & SU-A-957103 (Kuban Agric Inst) 09.09.1982 ----	1	
A	SOVIET INVENTIONS ILLUSTRATED, Derwent Publications, Chemical Section week E 24, 28 July 1982, abstract no. 49916, D13S03; & U-A-857871 (Kuban Agric Inst) 23.08.1981 -----		TECHNICAL FIELDS SEARCHED (Int. Cl.5)  G 01 N
The present search report has been drawn up for all claims			
Place of search BERLIN		Date of completion of the search 30-06-1990	Examiner BRISON O.P.
<b>CATEGORY OF CITED DOCUMENTS</b> X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document  T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ----- & : member of the same patent family, corresponding document			